REMARKS

This Response is submitted in response to the Office Action dated April 4, 2008. Claims 1-10 were previously cancelled. Claim 11 has been amended to correct a typographical error. The Office Action rejects Claims 11-19 under 35 U.S.C. §103(a) as being obvious over U.S. Patent No. 5,250,167 to Adolf et al. ("Adolf"), in view of Hirai et al. ((2003) Proc. of SPIE 5051: 198-206), U.S. Patent No. 6,249,076 to Madden et al. ("Madden"), and U.S. Patent No. 6,475,637 to Shahinpoor et al. ("Shahinpoor"). Applicants respectfully disagree with and traverse the rejections for at least the reasons below. The Commissioner is hereby authorized to charge deposit account 02-1818 for any fees which are due and owing.

Of the rejected claims, Claim 11 is the sole independent claim. Amended Claim 11 recites, at least in part, a polymer actuator including: a plurality of gel/electrode complexes arranged in an electrolytic aqueous solution, each of *said gel/electrode complexes being composed of* a polymer gel containing at least one of acidic and basic functional groups *and electrodes placed in the polymer gel*, said electrodes being made of a material capable of occluding and releasing hydrogen electrochemically, such that the polymer gel in each gel/electrode complex changes in pH upon application of voltage across the electrodes of the gel/electrode complexes, and each of the gel/electrode complexes changes in volume in response to the pH change. As mentioned above, the amendments to Claim 11 were made for clarification purposes and to correct a clerical error.

One nonlimiting example of the presently claimed invention is illustrated in Figs. 2A and 2B of the present application. In this example, the polymer actuator 1 includes a container 5 having flexible walls and ends 5'. (See, Figs. 2A and 3B). Housed in container 5 are two gel/electrolyte complexes 4a and 4b. The gel/electrolyte complexes 4a and 4b each include a polymeric hydrogel 2a and 2b having basic or acidic functional groups. An electrolyte aqueous solution 6 surrounds the gel/electrolyte complexes 4a and 4b within the container 5. As shown in Figs. 2A and 2B, the *electrodes 3a and 3b are placed in* and extend through the gel/electrolyte complexes 4a and 4b. In this example, the electrodes 3a and 3b are coil shaped and stretch or expand along with the hydrogel 2a and 2b when the polymeric actuator 1 is expanded. As shown in Figs. 2A and 3B, the cathode 3b and the anode 3a are located on the same side of the

polymeric actuator 1. The cited references fail to disclose or suggest several features of the presently claimed invention, even assuming that they are properly combinable.

The Office Action relies primarily on the Adolf reference. Adolf discloses electrically controlled polymeric gel actuators. As shown in Fig. 1 and Fig. 1a, polymeric gel actuator 10 is shown in its contracted and expanded states, respectively, and includes hermetically sealed cylindrical shell structure 12, having a flexible wall 14 and end plates 16 and 18. (See, Adolf, col. 1, lines 49-68). Shell structure 12 contains an electrolytic solution 20 such as a 1.0 weight percent solution of NaCl in water. (See, Adolf, col. 1, lines 49-68). End plate 16 serves as a cathode and end plate 18 serves as an anode upon application of an electrical potential from power source 22. (See, Adolf, col. 1, lines 49-68). Motive power is provided by the polyelectrolyte polymeric gel 24. (See, Adolf, col. 1, lines 49-68). These gels may be cylindrical electromechanical gel such as polyacrylamide, or a mixture of polyvinyl alcohol-polyacrylic acid arranged in a parallel aggregate. (See, Adolf, col. 1, lines 49-68). Gel 24 is located within cylindrical shell 12 with one end attached to end plate 18 in any appropriate manner such as by stringing through holes or hooks formed in end plate 18. (See, Adolf, col. 1, lines 49-68). An inert spacer 26 is connected between cathode end plate 16 and the other ends of gel 24. (See, Adolf, col. 2, lines 1-25). Spacer 26 serves to keep fibers 24 ionically isolated from cathode end plate 16, as discussed hereinafter. (See, Adolf, col. 2, lines 1-25). Spacer 26 is a necessary component of the embodiment of FIG. 1. If fibers 24 were also connected directly to cathode 16, application of the voltage from source 22 would cause the ends at cathode 16 to expand while the ends at anode 18 contract, resulting in no net mechanical force being applied between the electrodes. (See, Adolf, col. 2, lines 1-25). However, Adolf fails to disclose several elements of the presently claimed invention.

As admitted in the Office Action, Adolf fails to disclose use of a palladium catalyst or a coil/mesh structure as an electrode structure. (See, Office Action, pg. 3). Moreover, Adolf fails to disclose or suggest electrodes placed in the polymer gel, as recited in amended Claim 11. As discussed above, Adolf discloses the anode 18 and cathode 16 on separate ends of the actuator 10. Moreover, there is no disclosure of electrodes being placed in the polymer gel itself, or extending through the polymer gel as in the example described above with regard to the present application. Moreover, it would appear that the presence of the spacer 26 (which Adolf

describes as "necessary") would teach away from placing an electrode in the gel/electrolyte complex, where the spacer is not configured to expand or contract in response to the applied voltage (i.e., see the constant dimensions of spacer 26 between Fig. 1 and Fig. 2). Accordingly, Adolf fails to disclose or suggest several features of the presently claimed invention.

The Office Action relies on the remaining references to allegedly cure the deficiencies of Adolf. It appears the Hirai reference may be relied on for an alleged disclosure of using a range of gels, using electrodes on both sides of the gel container, and for the addition of dopants to the gel. (See, Office Action, pgs. 3-4). Madden is relied on for alleged disclosure of palladium as an electrode material. (See, Office Action, pg. 4). These references, even if properly combinable, do not cure the deficiencies of Adolf, as discussed above.

Finally, Shahinpoor is relied on for the alleged disclosure of "a porous conductive layer embedded in said polymer with penetration inside said polymer comprising at least two embedded electrodes wherein application of an electric potential across said electrodes causes movement of said polymer *in a dry environment*." (See, Office Action, pg. 4, emphasis added). Applicants note that the primary Adolf reference is discussed in detail in the background section of Shahinpoor. (See, col. 2, lines 21-39). In particular, Shahinpoor appears to tout the disadvantages of using polymeric gels: "the disadvantage is that actuator performance is dictated by the parameters of the polymeric gel used ... furthermore, liquid containment is required to make the actuators stronger and not so easily broken." (See, Shahinpoor, col. 2, lines 35-39). In addition, Shahinpoor discloses that "the sensors of the present invention also have a very broad bandwidth and can sense oscillatory motion at rates of up to hundreds of Hz, unlike most polymeric gels." (See, Shahinpoor, col. 14, lines 4-7). Accordingly, not only does Shahinpoor fail to disclose or suggest an electrode in a polymer gel, but Shahinpoor does not appear to be properly combinable with Adolf for the reasons discussed above. Applicants also respectfully submit that the reliance on a coil structure in Shahinpoor is misplaced, where the Adachi reference disclosed in col. 3, lines 19-26 of Shahinpoor relates to a completely different field of endeavor and it appears that the "coil" structure does not even relate to an electrode, much less an electrode that is placed in a gel/electrolyte complex, as recited in the present claims.

For at least the reasons above, Applicants respectfully request withdrawal of the 35 U.S.C. §103(a) rejections of Claims 11-20.

Accordingly, Applicants respectfully submit that the present application is in condition for allowance and earnestly solicit reconsideration of same.

Respectfully submitted,

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